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THE ELECTRIC TELEGRAPH.

BEACON-fires were the ancient mode of telegraphy adopted in Great Britain. An act of the Scottish parliament of 1455 directs that 'one bale or fagot shall be the warning of the approach of the English in any manner; two bales, that they are coming indeed; and four bales blazing beside each other, that the enemy are in great force.' The earliest well-defined plan of telegraphic communication is that of Dr Robert Hooke, described by him in a paper to the Royal Society in 1684, and published in 1726 in Derham's collection of his *Philosophical Experiments and Observations*. A number of symbols or devices were to be displayed on an elevated framework. M. Chappe much improved on this in 1793. A kind of shutter telegraph was in 1796 adopted in England in the first government line of telegraph from London to Dover. It is stated that information had been conveyed by this from Dover to London in seven minutes. This, of course, was only available in clear weather.

We now come to the electric telegraph, by which Puck's fairy boast of putting a girdle round the earth in forty minutes can be realised, though, instead of forty minutes, it can be done in *one second*. Strada, the Italian Jesuit, speaks in his *Profusiones Academicæ*, in 1617, of 'the instantaneous transmission of thoughts and words between two individuals over an indefinite space,' caused by a species of loadstone, which possesses such virtue, that if two needles be touched with it, and then balanced on separate pivots, and the one turned in a particular direction, the other will sympathetically move parallel to it. These needles were to be poised, and mounted parallel on a dial with the letters of the alphabet around. It is wonderful how nearly this description would apply to the electric telegraph. Addison playfully quotes this as a substitute for love-letters in the *Spectator* of 1712. Glanvil, in a work addressed to the Royal Society two hundred years ago, treating of things, then rumours, which might be practical realities, says: 'To confer at a distance of the Indies by sympathetic conveyances, may be

as usual to future times as to us in literary correspondence.' Experiments of making electric shocks through wires had been made many times before Franklin's theory of positive and negative electricity was started. Mr Timbs states that in the *Scots Magazine* for 1753 there appeared a distinct proposition for a system of telegraphic communication by as many conducting wires as there are letters in the alphabet. Arthur Young, in his *Diary*, October 16, 1787, states that a French mechanic named Lomond had made a remarkable discovery in electricity. 'You write two or three words on paper; he takes it with him into a room, and turns a machine enclosed in a cylindrical case, at the top of which is an electrometer, a small fine pith ball; a wire connects with a similar cylinder and electrometer in a distant apartment; and his wife, by remarking the corresponding motions of the ball, writes down the words they indicate; from which it appears that he has formed an alphabet of motions. As the length of the wire makes no difference in the effect, a correspondence might be carried on at any distance—within and without a besieged town, for instance.' This is, to all intents and purposes, the electric telegraph. In 1812, Mr Crosse the electrician uttered this prediction: 'I prophesy that by means of the electric agency, we shall be enabled to communicate our thoughts instantaneously with the uttermost parts of the earth.' In the same year, Francis Ronalds employed frictional electricity. His telegraph was a single insulated wire, the indication being by pith balls in front of a dial. In the next year, Mr Hill, of Alfreton, invented a voltaic electric telegraph.

Oersted discovered, in 1819, that a magnetic needle is deflected by the passage of a circuit of electricity through a wire parallel and in close proximity to it. This made the wonderful discovery of the telegraph possible. But the deflecting power of the current must be multiplied, and Schweigger did this by passing a wire insulated by silk a number of times round the needle. M. Arago, in 1819, invented the first electro-magnet, by coiling round a piece of soft iron a length of

insulated copper wire, the ends of which communicated with a battery. By alternately making and breaking the circuit of the current, an up-and-down movement can be produced, which is the principle of action in Wheatstone's electric magnetic dial instrument. These discoveries do not seem to have been followed up in a practical manner till, in 1837, Wheatstone took out a patent in conjunction with Mr Cooke. Their telegraph had five wires and five needles, two of which indicated the letters of the alphabet placed around. In July 1837, wires were laid down from Euston Square to Camden Town Stations, by the sanction of the North-western Railway, and Professor Wheatstone sent the first message to Mr Cooke between the two stations. The professor says: 'Never did I feel such a tumultuous sensation before, as when, all alone in the still room, I heard the needles click; and as I spelled the words, I felt all the magnitude of the invention, now proved to be practical beyond cavil or dispute.' The form of telegraph now in use was substituted for this because of the economy of its construction, not more than two wires (sometimes only one) being required. Of course several persons claimed to have invented the telegraph before Professor Wheatstone. In the same month that the professor was working upon the North-western Railway, there was one in operation invented by Steinheil of Munich, but Wheatstone's patent had been taken out in the month before. An American named Morse claims to have invented it in 1832, but did not put it into operation till 1837. After this, his system was generally adopted in the United States. It is a *recording* one.

Mr Brunel adopted Wheatstone's telegraph on the Great Western, and the wires at this time were not carried on posts, but placed in a tube under ground. But soon after a gentleman, at a meeting of the shareholders, said the whole was a 'new-fangled scheme,' and actually got a resolution passed repudiating the agreement with the patentees. They were, however, graciously permitted to work the wires at their own expense. The tariff was one shilling per message; curiously enough, the very sum now charged since the wires in Great Britain have been transferred to the government.

Sir M. I. Brunel and Professor Daniell thus speak of the relative positions of Messrs Cooke and Wheatstone in the invention of the electric telegraph: 'Whilst Mr Cooke is entitled to stand alone as the gentleman to whom this country is indebted for having practically introduced and carried out the electric telegraph, as a useful undertaking, promising to be a work of national importance—and Professor Wheatstone is acknowledged as the scientific man whose profound and successful researches had already prepared the public to receive it as a project capable of practical application—it is to the united labours of two gentlemen so well qualified for mutual assistance, that we must attribute the rapid progress which this important invention has made during the five years since they have been associated.'

In 1840, Professor Wheatstone invented the revolving dial telegraph, working without any clock-work power: a magneto-electric machine supplies the place of a voltaic battery. In 1841, he invented the type-printing telegraph. The American printing telegraph of House has much complicated mechanism, but does its work well;

and messages are printed by it at the rate of fifty letters per minute in common Roman characters on long slips of paper. Bakewell's telegraph is of this kind, though, if possible, more ingenious. Formerly, an alarm used to be sounded by an electro-magnet, to arouse the operator, but the clicking of the needle is found quite sufficient. When a message is sent between London and Edinburgh, all the needles of all the telegraph stations on the line are deflected at the same time; but a special signal is made to shew for which station the message is intended. Dr Wynter mentions a somnolent station-clerk, who, in order to enjoy a nap, trained his terrier to awake him at the clicking of the needles.

The new magnetic alphabet-dial telegraph, invented by Wheatstone in 1858, and improved in 1860, was used by the Universal Private Telegraph Company, and by private individuals in great numbers. On a dial-like face, the letters of the alphabet are placed, with accordion-like keys round. By touching these, a communication is obtained with a like instrument at the end of the wire. The professor found the best way of working the private telegraphs in the metropolis was by a number of wires, not thicker than pack-thread, bound together in a cable, but isolated from each other by an india-rubber process, patented by the Messrs Silver. This, of course, greatly reduces the cost. Suspending-posts were placed at intervals of one hundred yards, and connecting boxes to combine and arrange the various lines—the boxes a mile apart. Faults can be easily discovered by a very ingenious arrangement at each suspending-post. The charge for the use of a wire to an individual and working instruments is about sixteen pounds a mile per annum. It is impossible to overestimate the importance of this to the British merchant, who may at his country residence know all that is going on at the docks without leaving his library. Dr Wynter says that Lord Kinnaird has laid one down from Rossie Castle to the neighbouring county town, eight miles distant, and orders to the tradesmen are sent by it.

The fast-speed automatic telegraph, invented by Wheatstone in 1858, and improved in 1867, is perhaps the most wonderful of the professor's inventions. He thus describes it: 'My invention consists of a new combination of mechanism, for the purpose of transmitting through a telegraphic circuit messages previously prepared, and causing them to be recorded or printed at a distant station. Long strips or ribbons of paper are perforated, by a machine constructed for the purpose, with apertures grouped to represent the letters of the alphabet and other signs. A strip thus prepared is placed in an instrument, associated with a rheomotor (or source of electric power), which, on being set in motion, moves it along, and causes it to act on two pins, in such manner that, when one of them is elevated, the current is transmitted to the telegraphic circuit in one direction; and when the other is elevated, it is transmitted in the opposite direction: the elevations and depressions of the pins are governed by the apertures and intervening intervals. These currents, following each other indifferently in the two opposite directions, act upon a printing or writing instrument at a distant station in such manner as to produce corresponding marks on a ribbon of paper, moved by appropriate mechanism.' He soon found, after

devoting his attention to fast-speed telegraphs and dot-printing, that a rapid printer was required. This he invented by the name of the 'line-printer,' printing the dot and dash alphabet at the rate of six hundred letters per minute. It would be impossible, in our limited space, to give descriptions of the working of the various varieties of the telegraph; but we refer our readers to Professor Pepper's recent volume, *Cyclopaedic Science Simplified* (Warne & Co., 1869), for capital descriptions and woodcuts of these instruments.

In 1843, Mr Cooke had the wires of the telegraph suspended on posts, instead of conveying them underground. Iron wire galvanised is used for these lines; but in the neighbourhood of large manufacturing towns, the sulphur in the air converts the oxide into sulphate of zinc, which the rain washes off, to the great detriment of the wire. Lightning has been known to run for miles along the wire, melting the delicate coils in the instruments in the various stations along the line. The aurora borealis also affects the wire. In September 1851, it prevented any messages being sent in New England in the United States. Professor Wheatstone, by elaborate experiments, discovered that electricity travels through a copper wire at the rate of two hundred thousand miles per second, or the velocity of light; and Professor Bache, that through iron wire the velocity was fifteen thousand four hundred miles a second. About one ton of wire is required for every five miles. The wires were attached to the posts by brown salt-glazed stoneware of the hour-glass shape; but Mr E. Clark invented a method of placing them on a stoneware hook, open at the side, so that the hook could be replaced if required. In India, the delicate wires used here would not be suitable; so iron rods three-eighths of an inch thick are employed. Rain may pour on them and monkeys sit on them without doing any damage. In Whitworth's *Report*, it is stated that in America, in certain states of the atmosphere (rain carrying much of the electricity from the wires), Bain's telegraphs will work when Morse's will not.

The needle instruments transmit the messages much more quickly than the recording ones; but in the latter, an indelible record of every message transmitted is made, which is of great importance.

There is one man who has done an immense deal to utilise telegraphic information; we mean Mr Reuter. In 1849, he opened an office at Aix-la-Chapelle, and had carrier-pigeons to convey messages from that place to Brussels, as the telegraph was not formed there at that time. In 1851, he transferred his office to London, and devoted his attention to inducing the British press, which obtained information at an enormous cost, to depend on him for it. In 1853, to shew what he could do, he sent his telegrams to the various papers, free of cost; and they were so impressed with their value, that several subscribed to his system. In February 1859, the Emperor of France made the famous speech threatening Austria through her ambassador. This was delivered at 1 P.M., and at 2 P.M. the speech was published in the third edition of the *Times*, having been transmitted by Mr Reuter. The press soon adopted his system, and the daily papers in the north have the same telegrams as those of the metropolis. The wires are connected in London from Mr Reuter's office into

the editor's room of each journal. It is stated that Mr Reuter sold his business to government recently at a premium of three hundred thousand pounds.

The first newspaper report by electric telegraph appeared in the *Morning Chronicle*, May 8, 1845, detailing a railway meeting held at Portsmouth on the preceding evening. A chess-match was played in April 1845 by telegraph between amateurs in London and Mr Staunton and Captain Kennedy in Gosport. The contest began at 11.30 A.M., terminating about 7 P.M., the time being taken up by the consideration of the players over the moves. The squares of the board and the men were numbered, and the electric fluid must have travelled at least ten thousand miles during the game.

Many a thief has been caught by the aid of the telegraph, as information can be sent to stop him if he has started in a train at some distant station. Tawell the murderer is another instance of this. Sarah Hart had been murdered in 1845 at a cottage in Salt Hill, and a man in Quaker attire had been seen to leave the house. A clergyman hearing he had been supposed to have gone to Slough, went there, and saw the Quaker-like man enter a first-class carriage. A telegraphic message was despatched to London, and a detective followed Tawell, and he was subsequently apprehended. He nearly escaped in this manner: the letter Q was then represented by K, and the clerk in London could make nothing out of *Kuaker*, but fortunately guessed it in time to be Quaker.

Here is an example of laconic telegraphy. A person who had committed an offence against the laws, and run away, desired to know if it would be prudent to return. He asked: 'Is everything O. K.?' The answer was: 'Proverbs xxvii. 12.' Upon referring to this, he found: 'A prudent man foreseeth the evil, and hideth himself; but the simple pass on, and are punished.'

Elihu Burritt tells us how a train of passengers was saved from destruction by a message by telegraph. A long railway bridge was blown down between Hartfield and Springfield, in the United States, and the train was stopped by telegraphing to a distant station. Mr Walker, superintendent of the telegraphs of the South-eastern Railway Company, states that in 1850 a collision occurred to an empty train at Gravesend, and the driver leaping from the engine, it started full speed for London. The line was kept clear by the telegraph, and an engine started in pursuit, fortunately overtaking it. But it had passed twelve stations safely before this.

We now turn to submarine telegraphy. Professor Morse is said to have made the first practical experiments in this part of the subject in 1842. Wheatstone laid wire across the bed of the Thames eight months after Morse's experiment. It is probable that if gutta-percha had not been discovered in the Eastern Archipelago, electric communication could not have been made to any extent through water. This substance was first applied for insulating in 1847 by Lieutenant Siemens, of the Prussian artillery; and Faraday used it in electrical experiments in 1848; and in 1850 the first submarine cable was laid between Dover and Cape Gris-nez. This soon broke from friction on a sharp ridge of rocks. Another was soon laid down

of better construction, and this was a great success, and has remained so. Then one followed to Ostend, connecting us with Europe through Belgium. In May 1853, another cable was laid down from Orfordness, near Ipswich, to Schevening in Holland: this goes for one hundred and twenty miles under the North Sea. In 1849, Mr J. J. Lake submitted a plan to the *Athenæum* for connecting the electric telegraph with America by a wire covered with gutta-percha. The first Atlantic cable was finished in 1857 by Glass & Co. of Greenwich, and Newall of Birkenhead. It was paid out successfully to the extent of three hundred and fifty-five miles. At this point it parted from the strain, and was lost for ever. In 1858, another cable was ready, being made under the direction of Mr Cyrus Field. But it broke several times before it was finally laid in August 1858. It worked well for a time, and then became useless. Till 1865, no fresh attempt to lay another was made. Sir Charles Bright recommended a combination of iron wire and hemp for the outer protecting strands. Two thousand six hundred miles were placed on the *Great Eastern*. The central conductor was composed of seven fine copper wires, with four layers of gutta-percha, and then eleven iron wires. In strength it was equal to a strain of seven and three-quarter tons. It was constructed by Messrs Glass and Elliott at East Greenwich. The *Great Eastern* sailed from Valencia, July 23, 1865. As it was being paid out, two faults were discovered which would have been fatal to the working of the line. Stout iron wire had been driven through the cable, some said purposely. On August 2, the cable broke, to the consternation of all on board. The great ship then determined to grapple it, and from August 3 to August 11 the cable was grappled three times; and on the latter day, the grapnel being found defective, and the stock of wire-rope exhausted, the *Great Eastern* moored a buoy, and returned home. Thus £1,250,000 was sunk at the bottom of the ocean. Another cable was constructed, and began to be paid out July 13, 1866, and on July 27, Newfoundland was sighted. In August, a telegram was sent from New York to Bombay, going across a wide stretch of America, spanning the Atlantic, crossing Ireland and England, Europe, Asia Minor, Persian Gulf, and Indian Ocean to Kurrachee. In September 2, the 1865 cable was raised from the bed of the Atlantic by the *Great Eastern*. Experiment proved that the communication was perfect. On September 8, the *Great Eastern* finished paying out, the 1865 cable being then landed at Newfoundland. A banquet was given at the Royal Polytechnic, December 21, 1867, to Sir C. Wheatstone; the Duke of Wellington and others were present. The wires of the Atlantic cable were brought into the room, and the following message was sent to the President of the United States: 'The Duke of Wellington, the directors and scientific guests now at the Royal Polytechnic, London, send their most respectful greeting to the President of the United States, their apology being, that to the discoveries of science the intercourse between two great nations is indebted.' This message was nine minutes thirty seconds in transit from London to Washington, by Heart's Content and New York. The following reply, occupying twenty-nine minutes in transmission, was received: 'I reciprocate the friendly salutation of the banqueting-party at the

Royal Polytechnic, and cordially agree with them in the sentiment, that free and quick communication between governments and nations is an important agent in preserving peace and good understanding throughout the world, and advancing all the interests of civilisation.—ANDREW JOHNSON.'

On the same evening, a message of twenty-two words was started from the same institution for Heart's Content at 9 P.M., and at 9.10 the reply of twenty-four words was delivered.

Electrical tests applied to these two cables shew them to be at least twenty times better in conductivity and insulation than on the first day they were submerged. Their earnings average about £700 a day. We cannot wonder, therefore, that the French wished to have an independent line for themselves, making the third line to America. The new French cable is about 3564 nautical miles in length—nearly double that of either of the English ones. The principle of construction is the same, only the French conductor weighs 100 pounds more per mile than ours. The Manila hemp used is saturated with tar—another advantage. The Anglo-American companies have the sole right of landing cables on Newfoundland, so this cable has to go from Brest to St Pierre, and from St Pierre to Massachusetts. The standard of the manufactured value of a cable is judged by what are called units of resistance. The amount of resistance to the passage of the electric current through the conductor is measured by the galvanometer, and is counted by millions of units: a cable giving a low rate of resistance would shew that some hidden leakage allowed the current to escape, and so to enter the wire faster than it ought. The Persian Gulf cable had a resistance of 50,000,000 units; the Atlantic cable of 1865, 100,000,000 units; that of 1866, 150,000,000 units; and the new French cable no less than 250,000,000, shewing a great increase of perfection in the manufacture.

AN ENGAGED MAN.

IN TWELVE CHAPTERS.—CHAPTER VIII.

BOGER did not stop to close the street-door after him.

For very many years he had not run so fast as he ran that night. Indeed, for very many years he had not run at all; his quickest pace upon the most urgent provocation had been but a mild kind of amble; now he more than trotted—he even galloped. Weighted as he was with years and redundant flesh, his speed of movement distressed him sorely. Still he kept on—bravely is not the right word—let us rather say with the energy of despair. He was trembling all over—panting, perspiring; agonising groans seemed to be jolted out of him as he sped along; his limbs threatened to give way beneath him; his heart was whirled about as in a churn, now banged against his ribs, now tossed up to his throat. He had never felt his feet so tender, or the paving-stones so hard. He hardly knew what he did—whether he was bound; but a wild desire to leave Sackbut Place behind him—to have some space between himself and Mrs Kettlewell—possessed him absolutely. It was not a moment for deliberate thought, or he might have reflected regretfully on his lack of training, his utterly bad form and condition for the violent exercise he was undergoing.

Perhaps mechanically—certainly with no very

clear intention—his steps carried him towards the Acropolis. Gradually his reason cleared. He must have aid and advice; he could not act for himself in the strange trouble that had come upon him; he had long resigned action; it was not in his line; he was helpless, feeble, incapable as a child; he must have some one to lean upon—to counsel him, to act for him, or at least to tell him what had best be done. Pettigrew was his man—who else? Pettigrew's sagacity was proved: had he not foreseen something of the frightful difficulty that had arisen? Pettigrew was at the club when Boger quitted it; he would rejoin Pettigrew.

The figure of a stout gentleman fleeing down Piccadilly at midnight occasioned some stir. The policeman viewed him half with derision, half with suspicion. Ought he to follow? Was there mischief afoot? Was it for a wager, or a tipsy frolic, that this pedestrian John Gilpin thus raced on his way? Or was he a father of a family, about to be increased, hastening for the doctor? So the constable questioned himself, obtaining unsatisfactory responses, and then, constable-like, doing nothing. Belated street-boys and hilarious night-revellers raised shouts and cries of ridicule, outstretched their arms, and feigned attempts to stay the fugitive or obstruct his path. But, now on the pavement, now in the roadway—in dire peril from the wheels of Hansoms—Mr Boger held on.

'Mr Pettigrew!' he gasped at the door of the Acropolis, and nearly reeled into the friendly arms of the hall-porter.

'Just gone, sir—not a minute ago. Nothing wrong, sir, I hope?'

'Gone!' cried Boger, with a moan of anguish, and then turned from the Acropolis and fled anew. He knew where Pettigrew lodged—in a modest chamber over a bootmaker's shop in Jamin Street, St James's. Boger ran thither; fortune favoured him for once: he found Pettigrew on the door-step, just about to turn his key in the door, and withdraw for the night. Boger clutched feebly at his friend's arm.

'Be off! I've no halfpence, I tell you!' Then, in an altered tone, Pettigrew continued: 'I beg your pardon. Good heavens! Boger! Is it you?'

'At last I've found you, thank God!' Boger had breath for no further utterance. With a convulsive shiver and chattering teeth, he collapsed, and sank upon the door-step, crushing his hat in his fall, and narrowly escaping personal injury from the scraper.

'He's drunk,' said Pettigrew. 'Very odd; he was sober enough when he left the club an hour ago; never saw him like this before.—Come, I say, old man—get up; this won't do, you know; you can't do this here.' Pettigrew unconsciously had assumed quite the manner of a policeman confronting one intoxicated. He shook his visitor—then extended a helping, or rather perhaps an up-dragging hand to him, and at last had him nearly on his legs again—very insecure and decrepit legs they were. 'Come, that's better.' And he put Boger's hat straight for him, and brought back the bow of his cravat, which had veered round to the nape of his neck, to its proper anchorage under his chins.

'My dear Pettigrew,' Boger moaned amid distressing pantings, 'forgive me; I'm very ill.'

'I see you're not quite the thing.'

'I've no right to disturb you at this hour, I know.'

'Well, you haven't. But what's the matter?'

'That woman!—'

'What woman?'

'Mrs Kettlewell. Her conduct—perfectly awful—never heard of such a thing—if you only knew—if I could only explain—but my breath—the excitement—the alarm!—'

'You'd better come in, I think. It's cold on the door-step.' Pettigrew opened the door, and supported his friend into the passage, which smelt pungently of the boots in the adjoining shop, then propped him securely against the wall, while he lighted his candle. 'Can you manage to get upstairs, do you think?'

With the help of the balusters and his friend's shoulder, Boger laboriously mounted the staircase. Pettigrew conducted him into a cramped little apartment—also smelling strongly of boots, as indeed did every room in the house—and safely deposited him upon a hard and prickly sofa. 'Lie there, old man, and get your wind,' said Pettigrew. 'Never saw a fellow so blown in all my life.'

He was a lean, dry, sinewy man himself, and though old and wrinkled, his hair very gray and scanty, was yet capable of a good deal of muscular effort of a stiff kind. If his face was older, his figure was younger than Boger's. They were perhaps really of about the same age, however Boger might flatter himself as to his youthful advantages over his friend.

Pettigrew peered at the recumbent figure of Boger curiously. 'No; not drunk,' he decided, 'but terribly upset about something or another.' He unlocked a chiffonier, and took out a small decanter. He mixed a tumbler of brandy-and-water. 'Drink that,' he said simply. Boger obeyed. He would have complied with any direction in the state he was reduced to; and certainly he stood in need of some stimulant.

'That woman!' he moaned again presently.

'Ah!' Pettigrew nodded his head, with the air of saying: 'I told you so.'

'Read that.' Boger held out the marriage certificate—now very damp and crumpled.

Pettigrew smoothed it out on the table, drew a chair near, and sat down to deliberately examine the document submitted to him. He took out his eye-glasses, polished them with his silk handkerchief, and set them firmly astride upon his sharp bony nose. He regaled himself with a large pinch of snuff, and then slowly and solemnly read through the paper—re-perused it, turned it over to see if anything was endorsed upon it. He laid it down carefully at last, smoothing it afresh, took off his glasses, and then for a few moments sat speechless, staring at Boger.

Early in life, it may be noted, Pettigrew had served under government as a stipendiary magistrate at the penal and military station of St Mungo's, the largest of the Queen Anne Islands in the Pacific Ocean. Indeed, his present income for the most part consisted of the pension awarded him on his retirement from that responsible position. Occasionally something of his old judicial habit of mind and demeanour would assert itself. The present was clearly an opportunity for a demonstration of that kind. He mounted the bench again, so to speak, and prepared to adjudicate upon the matter Boger had brought under his notice. He was not quite clear yet whether Boger was a prosecutor or a prisoner under charge; but

he was ready to consider the matter with becoming gravity and impartiality, and, so far as he could, to pass sentence upon and commit anybody deserving of such punishment as it was within his jurisdiction to award.

'Well, that seems clear and straightforward enough. What have you to say to this—Boger? He was nearly saying 'prisoner,' or 'defendant.'

'It's the most mysterious—the most awful—the most unaccountable.'

'Well, well, it may be so. Don't waste the time of the court—I mean, don't let us lose any time.'

'It's some infernal trick on the part of that woman—some infamous conspiracy.'

'I've no evidence to that effect before me. Do you dispute the genuineness of this document?'

'I hardly know—I hardly like to think—what it means.'

'It means marriage before the registrar—a civil marriage; that's plain enough. Do you mean to say that you haven't married the woman mentioned here?'—he resumed his glasses for a moment, and studied anew the certificate—'Susan—yes; Susan Kettlewell, widow, of full age? Now, be careful.'

'My dear Pettigrew, what a question! How can you suppose—how can you for one moment—'

'Come, come; answer the question. Yes or no.'

'No; then. No; most distinctly.'

'And that you swear?'

'And that I swear,' repeated Mr Boger, involuntarily humouring his interlocutor's judicial manner.

Pettigrew paused, as though irresolute how to proceed, the while he eyed his friend with considerable suspicion. Boger's distress was acute.

'Why, look at the date of the confounded thing,' he urged at last.

'Hush! Keep your temper.' Pettigrew again resorted to his eye-glasses. 'The marriage is certified to have been performed on the 4th October last.'

'I was ill in bed—motionless—helpless at the time. You know I was, Pettigrew,' pleaded Boger piteously.

'This, of course, is only an informal and preliminary investigation,' said Pettigrew. He rose and went to his writing-desk, which stood on a table in the corner of the room. He was a man of precise and methodical habits, it seemed, and kept a diary. He turned back to some past entries, and then read out: "'4th October.—Called on Tomkinson at his club—early, by appointment, and breakfasted with him. Met old General Hickson, whom I've hardly seen since I left St Mungo's: he looks the worse for wear. At noon, called at Boger's; found him ill in bed—with rheumatic gout in his hands, knees, and feet—terribly pulled down. Met Simmons there, and had some talk with him. S. thinks badly of B.'s case; good constitution, but much impaired by careless feeding—over-indulgence at the table—B.'s full habit of body counts against his recovery, &c." I needn't read any more. Yes; we might make that evidence for what it's worth, and we might call Simmons.' He looked round, as though to instruct an usher of the court to bring Simmons before him—then checked himself. 'No doubt something might be done in the way of proving an *alibi*. Still, this certificate is unquestionably, to say the least of it, strong *prima facie* evidence of a marriage. Then you are found domiciled in the same place—under the same roof. As to general repute, I won't take upon myself to

say much; it's of little consequence, perhaps, in regard to an English marriage. It is clear, however, that your friends have not been without suspicion on the subject. They cannot but have perceived that this woman had obtained a peculiar influence and ascendancy over you. I venture to assert that such a marriage as this paper certifies to have taken place would not have surprised them. I may say that they were even, in some sort, prepared to hear of it, any day. The woman is what many people would call a fine woman—still. She'd been your housekeeper for many years. Men arrived at your time of life have often been known to marry their housekeepers. Her demeanour towards you could hardly be described as that of a servant—it was that of an equal—an intimate even.'

'Good heavens, Pettigrew, what are you driving at?' demanded Boger, with much anguish of expression.

Pettigrew, in an abstracted, summing-up sort of way, had been inflicting severe injuries upon his friend—probing him to the quick—pressing upon his wounds in the most painful manner. 'Do you mean solemnly and sincerely to declare that you're not married to Mrs Kettlewell?' re-demanded Pettigrew.

'Certainly not. Solemnly and sincerely—nothing of the kind; never dreamed of such a thing; wouldn't marry her at any price; wouldn't touch her with a pair of tongs,' Boger stuttered forth, inarticulate with anger and apprehension.

'Well, well, that's all beside the question. The question is'—Pettigrew hesitated a moment, as though himself in doubt as to what the question really was—'the question is: what do you mean to do?'

'I don't know,' Boger replied desperately. 'I want you to advise me—to help me. Something I must do. But what? For God's sake, tell me, Pettigrew.'

'Well, I suppose the proper course will be to indict her for conspiracy.'

'I'll do it!' cried Boger resolutely. 'I'll sift the thing to the bottom; I'll expose her; I'll shew up the whole scandalous trick; I'll appear against her at the Old Bailey; I'll be revenged upon her; I'll lock her up for this, if I have to spend hundreds of pounds to do it.'

'Very well, then. The first thing to-morrow morning, we must go down to Bokes and Bokes; you must put yourself in their hands: you've no great case at present, but they'll see that you have one before they've done with you.'

Bokes and Bokes, it should be noted, were attorneys of Jewish origin, famed for their adroitness and experience in criminal practice.

'Bokes and Bokes, by all means,' said Boger.

'That's settled, then; that's business, that is. We can do no more to-night.' Pettigrew thereupon ceased to be Pettigrew the stipendiary magistrate of St Mungo's, and became again Pettigrew of the Acropolis, Piccadilly—the friend of Bertie Boger.

'Have some more brandy-and-water,' he said. 'You mustn't go back to Sackbut Place, to-night.'

'I could not, I dare not,' Boger confessed tremulously; 'the sight of that woman would really kill me. If you could have seen her, Pettigrew—if you could have heard her!'

'Glad I didn't.'

'I wouldn't have believed it of her.'

'I would,' murmured Pettigrew. 'You must put up to-night with a shake-down on that sofa. I'll do the best I can for you: to-morrow we'll make better arrangements. There's a room upstairs you can have for a few nights, I daresay. I can lend you a collar and things. Only keep away from Sackbut Place.'

'I will,' Boger said promptly. Pettigrew did not doubt that he would.

'I feel wretchedly weak and ill, Pettigrew. Do you know I really believe I ran all the way to the Acropolis! Never ran so hard in my life.'

'Just so. Never mind; perhaps it will stave off a fit of the gout.'

'I must write to-morrow to the Lupuses; they'll be expecting me on Sunday; I shall not be able to go; I shall not be nearly equal to it; I must beg them to excuse me. I'd better, hadn't I?'

'Well, yes. It's as well to be off with the old love before you're on with the new; get rid of one wife before you take another,' Pettigrew advised with a grim smile.

Boger groaned.

CURIOSITIES OF INDO-ENGLISH CORRESPONDENCE.

ENGLISH residents in India get a number of letters from natives who may have occasion to apply to them either on matters of business, or to ask a favour, or obtain a situation. Some of these are well written—indeed, the handwriting is generally excellent—and in many cases the composition is marked by great propriety and good taste. But with many others it is very different, and the excellence of the penmanship and correctness of the spelling stand out in drollest contrast with the matter of the epistle. Tradespeople who are perfectly ignorant of any but their own tongue, send bills to their English customers. These they get written by some native scribe, who has learned enough of English, or at least is supposed to have learned enough, to be able to make out a bill of parcels, or a monthly statement of account which the *Sahab* or *Mem Sahab* will be able to read; or to write a note explaining anything unusual in the conduct of the business. As an instance of this, take the following two notes. They were sent by a butcher in Berhampore to a silk-factor at Beldanga with some beef, which being supplied without order, the butcher judged it necessary to send some explanation; and this is what he sent, *verbatim et literatim*. Outside, the address of both was the same: To the Great Honourable — Rid, Esquire. The first ran thus:

'To His Highness — Rid Esquire.—The humble butcher Nowkoury Respectfully sheweth that for your honour has sent a good beef, 1 Rump, pleased to take it, and to pay day labour of bearer coolly. As your obedient butcher shall ever pray.'

And the second was:

'To His Highness — Rid Esquire.—The humble butcher Nowkoury respectfully sheweth that your honour has sent a good peice of beef, 1 Brisket, 1 Rib, pleased to take it, and to pay day labour of coolly, and your butcher will not send in following weak any peice pleased to salt to this peice for other weak. As your obedient butcher shall ever pray.'

'Rid' is a native corruption of the gentleman's real name. We leave it so.

Next is one sent to the goods-clerk at the Mirzapore Railway Station. It sufficiently explains itself, except one word, 'reptile,' which is perhaps a mistake for 'replete.'

'Sir—I humbly beg you to cause the telegram received at last night to be sent to me for its correction, and not to bring this into my superior's notice, as man is reptile with the error.—I am yours obedt. servant, R. D. MOOKERJEE.'

This is to the same official

'Sir—With due respect and humble submision, I beg to inform you that I desire to be a probationer to your Goods Department, and I hope that you will be so kind enough as to teach me the way of official duties, otherwise please to order to your baboo to keep me and assist to Learning me the duties, weather Paid probationer or Unpaid which you Like, and keep me as a trial. Hoping that you will kindly or grant me this application on your kind Consideration, as I am very poor state at present. Consequently, as I am now without to employ, and shall ever remain and Pray for your long Life.—I Remain, Sir, Your most obedient servant, KEDAR NAUTH SINGHEE.'

From a scholar in a mission-school to the head-master:

'MY DEAR SIR—I, humbly beg to inform You pleas to give me leave for one week, because I could not walk with my feet, now I am very unfavourable. Give my compliments to My Master. I pray to God for everlasting life.—I am Your most humble and Obedient Servant,

SHEWEART LALL.'

Something might be added to this on the subject of *chits* (that is, notes), a most surprising number of which are received, and have to be answered, by most English people in India. Let any one in this country remember on how many occasions in a day he receives or sends a verbal message by a servant, a child, or a friend; or how often just by putting on his hat, and stepping out for a few yards, he asks a question of a neighbour, or gives him some news, or makes some little arrangement. Now, suppose that every such case had to be managed by a written note, and then you get a notion of the extent of such correspondence in India. Just putting on a hat, and stepping out to a neighbour's, is as little to be thought of there (for a good part of the year at least) as a walk from London to Brighton. And as to verbal messages, no one tries that plan after the vexatious trials in the early months of inexperience. Either because the native servants are so inattentive and forgetful, or because Europeans so rarely acquire a perfect command of the vernacular, or perhaps from both these causes together, a message sent verbally is always delivered wrongly. A very slight difference in the pronunciation will often make a great difference in the sense of a word. Thus, a lady, who was an excellent linguist, had a padlock brought to her instead of the brass dish she thought she had sent for; and the names of the two articles are so nearly alike, that it is difficult for Europeans to perceive the difference at all. Perhaps an inference may be drawn from this, that every one can tell you of the stupid

blunders his or her servants have made, notwithstanding the explicitness of their directions. A droll instance is that of a lady who sent to Mrs H—to ask after Mr H—, who was ill. Poor Mrs H—, wearied by nursing, was gone to lie down, and, loath to rise, gave the messenger a verbal answer. He went back, and, instead of reporting, as it was meant he should, that the Saheb was very ill, and the Mem Saheb was resting herself, announced the extraordinary intelligence that 'the Saheb is very wicked, and the Mem Saheb is a pig.'

BRED IN THE BONE.*

CHAPTER XVII.—WORKING ON A PIVOT.

NEVER had Richard been in such high spirits as on the evening of that day on which Harry had made confession to him of her love, and had promised to be his wife should her father's consent be gained. It was true that she had been far from sanguine upon the latter point; but Richard had his reason for being of a different opinion. It would be better, every way, if he could obtain Trevethick's good will; not that he at all shared in the girl's dread of his anger, but because it really seemed that if he married her from her father's roof he should be fulfilling his mother's injunctions in making alliance with an heiress. What with his two thousand pounds in gold, and his inn, and his lucky mine, it was plain that the old man would have no despicable sum to leave behind him; and yet, to do Richard justice, this only formed an additional incentive to a project upon which, at all events, he had long set his heart. He had resolved at all hazards to make the girl his wife. His love for her was as deep as it was passionate, and now that he was assured from her own lips of its being returned, his heart was filled with joy, and spoke out of its abundance. It had been hitherto his habit in that family circle round the bar-parlour fire to play the part of listener rather than of talker. He had mainly confined himself to the exhibition of an attentive interest in Solomon's stories, or in his host's sagacious observations with respect to the investment of capital, such as: 'One couldn't be too cautious where one put one's money;' and 'Where the interest was high, the risk was great, and where it was low, it was not worth while to let it leave one's hand.' Next to the subject of local superstition, 'investment' was the favourite subject of debate between Trevethick and 'Sol'; and Richard, whose ignorance insured his impartiality, had been the judicious scale-holder between them. But upon the present occasion it was the young artist who led the talk and chose the matter. He told them of the splendours of Crompton and of the marvellous prodigality of its owner, and they listened with greedy ears. To vulgar natures, the topic of mere wealth is ever an attractive one, and in the present instance there was an additional whet to appetite in the connection of Carew with Gethin. He was naturally an object of curiosity

to his tenant Trevethick, and never before had the old man had the opportunity of hearing at first hand of the eccentricities of the Squire. In relating them, Richard took good care to shew by implication on what intimate terms he stood with him, and hinted at the obligation under which he had put him by throwing his park gate open so opportunely. The impression which he left upon his audience, and desired to leave, was, that Carew was indebted to him for having saved his life.

'Then it is likely the Squire would do anything for you that you chose to ask him?' observed Trevethick, with the thought of his own debt to Solomon's father doubtless in his mind.

'Well, he certainly ought to do so,' answered Richard carelessly; 'but, on the other hand, it is not very probable that I shall put him to the test.'

'Just so,' returned Trevethick, sucking at his pipe; 'you're independent of the likes of him.'

'Altogether,' was Richard's reply.

The old man spoke no more, but sat in a cloud of smoke and thought for the rest of the evening. Even when 'Sol' rose up to go—Harry having retired long since, for they kept very early hours at the *Gethin Castle*—the landlord did not as usual accompany him, but mixed himself another glass of his favourite liquor. As for Richard, it was not his custom to seek his bed until after midnight, so Trevethick and he were left to one another's company. It was an opportunity to which the latter had been looking forward for many a day, but which he had never desired so keenly as at that moment.

'Are you likely to be at Crompton soon again?' inquired the landlord, pursuing the subject of the evening's talk.

'I have no intention of going there at present,' returned Richard. 'The fact is, Mr Trevethick, between ourselves, I am but a poor man in comparison with many of those I meet there, and their ways and habits are too expensive for me.'

'Ay! gambling and such-like, I suppose?' observed the landlord cunningly. 'It is "Light come, light go," with the money of that sort of folk, I reckon.'

'Just so; and though my money comes light enough—that is, I have not to earn it, since my mother makes me an allowance—I don't choose to risk it at the card-table.'

'Quite right, quite right, young gentleman,' answered the other approvingly. 'But there are some prudent gentry even at Crompton, I suppose. Parson Whymper, for instance, he don't gamble, do he?'

'Certainly not: he is much too sagacious a man, even if he were rich enough, to play; but for him, indeed, some say the Squire would have come to the end of his tether before this. He manages everything at Crompton, as you know.'

'And yet Carew don't want money?' said the landlord, musing.

'Well, I have been his guest,' returned Richard smiling; 'and it is scarcely fair of me to speak of his embarrassments. He does not certainly want it so much but that he can still afford to indulge his whims, Mr Trevethick, if *that's* what you mean.'

'That's just what I *did* mean,' said the old man frankly. 'Six months ago or so, I made a certain proposition to the Squire, which would have been exceedingly to his advantage to accept'—

* We have recently been informed that a story entitled *Bred in the Bone* appeared some years ago in the columns of a contemporary. There is no connection either of authorship or plot between that tale and the one now appearing in our own pages; but in consequence of this accidental coincidence of name, the present novel will appear, on republication, under the title of *Like Father, Like Son*.—Ed. C. J.

'And not to yours?' interrupted Richard slyly.

'Nay, I don't say that, sir,' answered the other. 'But it was one that he ought to have been glad to accept in any case, and which it was downright madness in him to refuse, if he wanted cash: it was a chance, too, I will venture to say, that will never offer itself from any other quarter. Mr Whympier acknowledged that himself.'

'I know all about the matter, Mr Trevethick: the Squire behaved like the dog in the manger to you. He won't work the mine himself, nor yet let you work it.'

'For mercy's sake, be quiet,' cried the landlord earnestly, and looking cautiously about him. 'If you know all about it, you need not let others know. What mine are you talking about? Give it a name—but speak it under your breath, man.' The old man leaned forward with a white moist face, and peered into Richard's eyes as though he would read his soul.

'Wheal Danes was the name of the place, if I remember right,' said Richard. 'Carew has a notion that the Romans did not use it up, and that it only wants capital to make it a paying concern: it is one of his mad ideas, doubtless.'

Mr John Trevethick was not by nature a quick appreciator of sarcasm, but he could not misunderstand the irony expressed in Richard's words.

'And is that what you came down to Gethin about?' inquired he with a sort of grim despair, which had nevertheless a comical effect.

Richard could only trust himself to nod his head assentingly.

'Well,' cried the other, striking the table with his fist, 'if I didn't think you was as deep as the devil, the very first day that I set eyes on you! So you are Parson Whympier's man, are you? And here, in default of language to express his sense of the deception that, as he supposed, had been practised on him, Mr Trevethick uttered an execration, terrible enough for a Cornish giant.

'I am not Mr Whympier's man at all,' observed Richard coolly: 'Mr Whympier is *my* man—or at least he will be one day or another.'

'How so?' inquired the landlord, his eyes at their full stretch, his mouth agape, and his neglected pipe in his right hand. 'Who, in the Fiend's name, are you?'

'I am the only son and heir of Carew of Crompton,' answered the young man deliberately.

'You? Why, Carew never had a son,' exclaimed Trevethick incredulously; 'leastways, not a lawful one. He was married once to a wench of the name of Harcastle, 'tis true; but that was put aside.'

'I tell you I am Carew's lawful son, nevertheless,' persisted Richard. 'My mother was privately married to him. Ask Parson Whympier, and he will tell you the same. It is true that my father has not acknowledged me, but I shall have my rights some day—and Wheal Danes along with the rest.'

The news of the young man's paternity must have been sufficiently startling to him who thus received it for the first time, and would, under any other circumstances, have doubtless excited his phlegmatic nature to the utmost; but what concerns ourselves in even a slight degree, is, with some of us, more absorbing than the most vital interests of another; and thus it was with Trevethick. The ambitious pretensions of his lodger sank

into insignificance—notwithstanding that for the moment he believed in them; for how, unless he was what he professed to be, could he know so much?—before the disappointment which had befallen himself in the overthrow of a long cherished scheme.

'Why, Mr Whympier wrote me with his own hand,' growled he, 'that in his judgment the mine was worthless, and that he had done all he could to persuade the Squire to sell. And yet you come down here to gauge and spy.'

'All stratagems are fair in war and business,' answered the young man, smiling. 'Come, Mr Trevethick; whatever reasons may have brought me here, I assure you, upon my honour, that they do not weigh with me now, in comparison with the great regard I feel for you and yours. If you will be frank with me, I will also be so with you; and let me say this at the outset, that nothing which may drop from your lips shall be made use of to prejudice your interests. I have gathered this much for myself, that Wheal'—

'Hush, sir!—for any sake, hush!' implored the landlord earnestly, and holding up his huge hand for silence. 'Do not give it a name again; there is some one moving above stairs.'

'It is only Solomon,' observed Richard quietly.

'I do not want Sol nor any other man alive to hear what we are talking about, Mr Yorke,' answered Trevethick hoarsely. 'You have gathered for yourself, you were about to say, that the mine is rich, and well worth what I have offered for it.'

'And a good deal more,' interrupted Richard. 'Perhaps a hundred times, perhaps a thousand times as much. We don't make so close a secret of a matter without our reasons. We don't see Dead Hands, with flames of fire at the finger-tips, going up and down ladders that don't exist, without the most excellent reasons, Mr Trevethick. What we wish no eye to see, nay, no ear to hear spoken of, is probably a subject of considerable private importance to ourselves. Come, we are friends here together; I say again let us be frank.'

Trevethick was silent for a little; he felt a lump rise in his throat, as though nature itself forbade him to disclose the secret he had kept so long and so jealously guarded. 'I have known it for these fifty years,' he began, in a half-choking voice. 'I found it out as a mere lad, when I went down into the old mine one day for sport, with some schoolmates. The vein lies in the lowest part of the old workings, at a depth that we think nothing of now-a-days, though it was too deep for the old masters of the pit. I remember, as though it was yesterday, how my heart leaped within me when my torch shone upon it, and how I fled away, lest my school-fellows should see it also. I came back the next day alone, to certify my great discovery. It is a good vein, if ever there was one. The copper there may be worth tens of thousands, hundreds of thousands, millions!' Never had the numeration table been invested with such significance. Trevethick's giant frame shook with emotion; his eyes literally glared with greed.

'You have been there since?' observed Richard interrogatively.

'Often, often,' answered the other hoarsely; 'I could not keep away. But nobody else has been there. The place is dark and perilous; there are rats, and bats, and eerie creatures all about it. And

folks are afraid, because of the Dead Hand and the Flame.'

'Your hand and torch?'

'Yes. I did my best to keep the place my own; my thoughts were never absent from it for a day. And when I had earned a little money, I put it by, and more to that, and more to that again, till I had got enough to make a bid for the lease of the old mine. But Carew was under age; so that fell through. I bided my time, and bid again; not much—not enough, as I fondly thought, to excite suspicion—but still what would seem a good price for a disused pit. Then I bid more and more; but Carew will neither sell nor let; and my money grows and grows in vain. I tell you I have laid by a fortune only to pour into his hand. It is ready for him to-night; there would be no haggling, no asking for time, it would be paid him in hard cash. How long, thought I, will this madman balk me with his whim? He will die some day in his cups, or break his neck in hunting, and I shall surely come in with my offer to his heir, and have my way at last, and win my prize. But now, after all my patience and my pains, I am overmatched by a Parson and a Boy.' He spoke with uncommon heat and passion; not complainingly. His face was dark, and his tone violent, and even menacing. There was no mistake about his having accepted his companion's invitation to be frank.

'Mr Trevethick,' said Richard gravely, 'your disappointment would be natural enough, if your long-cherished plan had really failed; but you have misunderstood me altogether. I am grateful to you for confiding to me the whole of what I had already guessed in part; and you shall have no reason to repent your confidence. Your secret is safer now than it has ever been; for from my lips Mr Whympster shall never have his suspicions with respect to Wheal Danes confirmed. I have been too long your guest, I feel myself too much the friend of you and yours, to act in any way to your disadvantage.'

Trevethick looked at him inquiringly, suspicion and disfavour glowing in his dusky face. 'But if your story is true, young gentleman, this mine will be your own some day?'

'It may, or it may not be, Mr Trevethick. My father's intentions are not to be counted upon, as you must be well aware, for twenty-four hours. But if ever Wheal Danes is mine'—Richard hesitated a moment, while the landlord devoured him with his eyes.

'Well,' cried he impatiently, 'what then?'

'I am willing to make over to you as soon as I come of age, by deed, all interest that I may have in it—on one condition.'

'Make over Wheal Danes to me by deed! What! at my own price?'

'For nothing; you shall have it for a free gift.'

'But the condition? What is it that you want of me that is not money?'

'I want permission from you, Mr Trevethick, to wed, that is—for I would not speak of love without your leave—to woo your daughter.'

'To wed my daughter!' cried Trevethick, starting from his seat; 'my Harry?'

'I say provided that my suit is not displeasing to her,' answered Richard, not without a tremor in his voice; for the old man's face was terrible to look upon. Hatred and Wrath were struggling there with Avarice, and had the upper hand.

He rocked himself to and fro, then answered in a stifled voice: 'My daughter's hand is already promised, young man.'

'It may be so, Mr Trevethick, but not by her, I think; and that her heart has not been given to the man you have designed for her, is certain. You may see that for yourself.'

'I tell you I have passed my word to Solomon Coe that she shall be his wife,' returned the other gloomily; 'and I am not one to go back from a bargain.'

'One can only promise what is in one's power,' urged Richard; 'your daughter's heart is not yours to give. In backing this man's suit, you have already redeemed your word to him. If he has failed to win her affections—and I think he has—let me try my chance. I am a fitter match for her in years; I am a gentleman, and therefore fitter for her, for she is a true lady. I love her a thousand times as much as he. As for Wheal Danes, I would give you twenty such, if I had them, for the leave I ask for, and the end I hope for.'

It was curious to mark how the mere mention of the mine by name affected the old man; his wrath, which seemed on the very point of explosion, was checked and smoothed at once, like raging waves by oil; his brow, indeed, was still dark and frowning, but he resumed his seat, and listened, or seemed to listen, to Richard's impassioned pleading. His genuine feeling made the young fellow eloquent, and gave a tender charm to his always handsome face and winning tones.

Perhaps even the unsympathetic Trevethick was really somewhat touched; at all events, he did not interrupt him, but when he had quite finished, took out his watch, and said in a softened tone: 'The hour is late, Mr Yorke, and you have given me much to think about, to which I cannot reply just now. Your communication has taken me altogether by surprise. I will answer neither "Yes" nor "No" at present.—Good-night, sir.' He nodded, which was his usual salute at parting; but upon the young man's eagerly stretching out his hand, he took it readily enough, and gave it such a squeeze with his giant fingers as made Richard wince. Then smiling grimly, he retired.

As his heavy step toiled up-stairs, Richard perceived a slip of paper on the floor, which had apparently fluttered out of the old man's watch-case. Upon it were written the three letters, B, N, Z. As he held it in his hand, he heard the landlord's tread returning with unusual haste, and had only just time to replace the paper, face downwards, on the sanded floor, before the other reappeared.

'I have dropped a memorandum somewhere,' said he. 'It is of no great consequence, but—Oh, here it is.' He picked it up, and replaced it in the hollow of his great silver watch.

Richard, who was sitting where he had left him, looked up with a glance of careless inquiry. 'Good-night again, Mr Trevethick.'

'Good-night, sir.' And again the landlord smiled in his grim fashion.

CHAPTER XVIII.—BY MOONLIGHT.

Richard sat over the fire, revolving his late conversation with Trevethick in his mind, and picturing to himself what would probably come of it. Although the declaration of his love for Harry

had been thus suddenly made, it had not been made unadvisedly. Though he had not expected the opportunity for stating it would have offered itself so soon, he had planned his whole argument out beforehand, with Wheal Danes for its pivot. And, upon the whole, he felt satisfied with its effect upon his host. The latter had not surprised him (except by his frankness) in his disclosure respecting the rich promise of the mine. Richard's own observation, aided by the clue which Parson Whympers' few chance sentences had given him, had convinced him that Wheal Danes was a most coveted object in the landlord's eyes; and had it happened to have fallen into his own hands, he did really suspect enough to have had it searched for ore from top to bottom. Trevethick had therefore lost nothing by his revelation (as his sagacity had doubtless foreseen), while he had made a very favourable impression upon Richard by his candour. Cornish giants, thought the latter, might be rude and brutal, but duplicity was foreign to their character; it was not Blunderbore, but Jack the Giant-killer, who dug pit-falls, and pretended to swallow what he only put in a bag.

Trevethick had certainly shewn strong disfavour to the young man's suit, backed though it was by such great pretensions; and it was evident that but for his hold upon him with respect to the mine, Richard would not have been listened to so patiently. However, his mouth had not been peremptorily closed at once (as he had expected it would have been), which was a great point gained; and the longer the old man took to think about the matter, the more likely was self-interest to gain the day with him. Supposing Richard's representations to have been correct, he was certainly 'a better match' for Harry than Solomon was; and he had no apprehension of their being refuted. Trevethick would in all probability write to Mr Whympers to inquire into the truth of them—but what then? He would certainly make no reference to the mine; and as to Richard's being Carew's lawful son, had not the chaplain himself (whom he could count on as a friend to say all that was to his advantage, besides) admitted that, in his eyes, he was born in honest wedlock? At all events, there would be ample excuse for his having taken such a view of the case; while, as to his prospects, he had frankly confessed that he was, for the present, unacknowledged by the Squire. So long, in fact, as he could keep up the pretence of influence, either present or contingent, at Crompton, he felt his position with Trevethick tolerably secure.

In all this scheme of dark deceit, his love for Harry was interwoven like a golden thread, and amid all his plots and plans, her glorious face would suddenly rise unbidden, and charm him from them. He had long since resolved to win her, but the late avowal of her love for him, and now his partial success to gain her father's favour, seemed to have made her his own already. How beautiful she had looked that day upon the tower, with the sunlight on her hair! How fresh and guileless were her ways! Her very weaknesses were lovable, and the cause of love. How touching was her simple faith in omens, and how pleasant to combat it, his arm about her dainty waist, as though to protect her from the shadow of harm! How pitiful her fear of her gruff father, and of this Cornish Solomon; and how sweet to

calm it, kissing her tears away! Once more his loving arms embraced her—once more his lips touched her warm cheeks—when a sudden noise awakened him from his dream of bliss.

The parlour fire had long gone out; it was warm for the time of year, but had it been otherwise, he would not have replenished it. The candles, too, had burned out, and the moonbeams were streaming through the window; but had it been dark, he would scarce have been aware of it. The house had long ago been hushed in repose, and yet Richard felt certain that he had heard a movement in the passage.

A stealthy step, yet not that of thief or burglar; a fairy footfall, rather, which was music to his ear. His heart leaped up to tell him that on the other side of the door was Harry Trevethick. He held his breath, and trembled—not for fear. Was it possible that, knowing he was sitting there alone, she had come down of her own choice to bear him company? Had her father told her something—some glad tidings which she could not keep from her lover even for a night? Or, filled with sweet dreams of him, as he of her, had she risen in her sleep, and been drawn involuntarily towards him by the loadstone of love? But—hark! The bolt that fastened the house-door was softly drawn, and the latch gently lifted. What could that mean? Why was she thus going forth alone, and clandestinely, at midnight? His heart beat faster than ever. For an instant, all that he had read or heard from his wild companions, and what he had himself believed until he came to Gethin, of the wiles and inconstancy of woman, flashed upon his mind. Had he, bred in the town, and familiar with all the ways of vice, been flattered and hoodwinked by a country wanton? Impossible. For, though there were no virtue in the world, he felt assured that Harry loved him, and him alone. She must be walking in her sleep. Softly, but very swiftly, he left the parlour, and hurried to the front-door. It was closed, but unfastened. He opened it, and looked out. All was as light as day, and yet so different. Every object in the street, every stone in the cottage opposite, stood out distinct and clear, but bathed in a pale and ghostly atmosphere. The distant murmur of the sea came to him like the sigh of one just freed from pain. Nothing else was to be heard; no human tread disturbed the midnight stillness; but along the winding road that led to Turlock, he caught the far-off flutter of a woman's dress. She was going at rapid speed, and the next moment had turned the corner, but not before he had recognised his Harry; and closing the inn-door softly behind him, he started after her like an arrow from the bow.

The scene of this pursuit was strange and weird enough, had Richard possessed eyes for anything but the object of it. The sky was without a cloud, and the sea—which shewed on its cold blue surface a broad and shining path where the moonbeams lay—without a ripple. On shore there was even less of motion. The bramble that threw its slender shadow on the road, moved not a twig. Nature, green and pale, seemed to be cast in an enchanted sleep, and even to suspend her breathing. From the point Richard had reached, he could see the road stretching for a full mile, like a white ribbon, save in the middle, where it dipped between high banks. It led to Turlock only, but at this

place a footpath struck across the fields, to the Fairies' Bower. To his astonishment, though indeed he had scarcely capacity enough for further wonder, Harry took this path; he saw her climb the stile, and then for the first time look round; he sank under the hedge, to hide himself; and when he cautiously looked forth again, the girl had vanished. But he knew whither she was going now. He had assisted her across that very stile but a few days ago, he had walked with her through the hazel copse, and skirted the clear trout-stream by her side; and he could follow her now at utmost speed, and with less caution, for the path was green and noiseless. He could hear his heart beat—not from want of breath—as though in accord with the silver treble of the stream, as he sped along. Through the scanty foliage of the dell, he saw her light dress gleam across the wooden bridge, but he himself stopped beside it, peering through the lattice of the branches upon her as she stood on the green bank of the Wishing Well.

Never had moonbeams shone upon a sight more fair. Harry was attired as she had been on the previous evening, except that she wore a shawl which also served her as headgear, like a hood. This she now unfastened, and taking out the pin that had joined it together, held it above the well, which shewed, as in a mirror, her leaning face and curving form, her wealth of hair, her frightened yet hopeful eyes, and the rise and fall of her bosom, filled with anxiety and superstitious awe. She had come to test her future—to foresee her fate—at Gethin Wishing Well. For an instant she poised the pin, her lips at the same time murmuring some simple charm—then dropped it into the well's clear depths, and watched it fall. As she did so, another figure seemed to glide upon the liquid mirror, at the sight of which she clasped her hands and trembled. Superstitious as she was, Harry had only half expected that her foolish curiosity would be actually gratified. Moved by the avowal of Richard's love that morning, the obstacles to which seemed to her so formidable, she had wished to see her future husband, to know how fate would decide between him she loved and him whom her father had chosen for her, and yet she was terrified now that that which she had desired was vouchsafed her. She scarcely dared to look upon yonder shadowy form, although its presence seemed to assure her of the fulfilment of her dearest wish. It was the counterfeit presentment of Richard Yorke himself; bareheaded just as she had seen him last in the bar parlour, but with heightened colour, an eager smile, and a loving gratitude in his eyes, which seemed to thank her for having thus summoned him before her. The figure was at right angles from her own, but the face was turned towards her. She gazed upon it intently, looking for it to faint and fade, since its mission had been accomplished. She even drew back a little, as though to express content, yet there was the vision still, a glorious picture in its fair round frame of moss and greenery. Supposing it should remain there (her pale face flushed at the thought) indelibly and for ever, to tell the secret of her heart to all the world! Then a whisper that seemed to tremble beneath its freight of love, whispered 'Harry, Harry!' and she looked up, and saw the substance of the shadow, her lover, standing upon the little wooden bridge!

Though Folly be near kin to Vice, she does not acknowledge the relationship, and, to do Harry Trevethick justice, she would never have made a midnight assignation with Richard in the Fairies' Bower. She was more alarmed and shocked at the too literal fulfilment of her wish, than pleased to see him there. She shed tears for very shame. Whatever reserve she had hitherto maintained with respect to her affection for him, had now, she perceived, been swept away by her own act. The scene to which he had just been an unsuspected witness was more than equivalent to a mere declaration of love: it was a leap-year offer of her hand and heart. She had no stronghold of Duty left to which to betake herself, nor even a halting-place, such as coy maidens love to linger at a little before they murmur: 'I am yours.'

There was nothing left her but revilings. She poured upon him a torrent of contumely, reproaching him for his baseness, his cowardice, his treachery in tracking her hither, like a spy, to overhear a confession that should have been sacred with him of all men. Whatever that confession might have been—and, to say truth, so utterly possessed had she been by her passionate hopes, her loving yearnings, that she knew not what she had merely felt, what uttered aloud—she now retracted it; she had no tenderness for eavesdroppers, for deceivers, for—she did not know what she was saying—for wicked young men. Above all things it, seemed necessary to be in a passion; to be as irritated and bitter against him as possible. The copiousness of her vocabulary of abuse surprised herself, and she did not shrink from tautology. She only stopped at last from want of breath, and even then, as though she knew how dangerous was silence, she bemoaned herself with sobs and sighs.

Then Richard, all tenderness and submission, explained his presence there; shewed how little he was to blame in the matter, and, indeed, how there was neither blame nor shame to be attached to either of them; spoke of his late interview with her father, gilding it with brightest hopes, and cited the marvellous attributes of the Wishing Well itself in support of his position. He felt himself already her affianced husband; the question of their union had become only one of time. She was listening to him now, and had suffered him to kiss her tears away, when suddenly she started from his embrace with a muffled cry of terror. Some movement of beast or bird in the copse had made a rustling in the underwood, but her fears gave it a human shape. What if Sol should have followed them thither, as Richard had followed her! What if her father should have heard her leave his roof, as Richard had, or should miss her from it—and—O shame!—miss him! 'Home, home!' she cried. 'Let me go home.' And she looked so wild with fright that he durst not hinder her. Hardly could he keep pace with her along the winding path, with such frantic speed she ran. At the stile, she forbade him to accompany her farther.

'What! leave you to walk alone, and at such an hour, my darling?' It was nearly two o'clock.

'Why not?' she cried, turning upon him fiercely. 'I am afraid of none but you, and of those whom I should love, but of whom you make me afraid.'

Then up the white road she glided like a ghost.

Richard watched her with anxious eyes as long as he could, then sat upon the stile, a prey to apprehensions. To what dangers might he not

have already exposed her by his inconsiderate pursuit! Suppose some eye had seen them on their way, or should meet her now on her return! Suppose her own fears should prove true, and her father had already discovered their absence! His thoughts were loyally occupied with Harry alone; but the peril to himself was considerable. It was impossible that he could satisfactorily explain his companionship with the innkeeper's daughter at such a place and hour. The truth would never be believed, even if it could be related. She had got home by this time, but had she done so unobserved? Otherwise, it was more than probable that he should find two Cornish giants waiting, if not 'to grind his bones to make their bread,' at least to break them with their cudgels. In their eyes, he would seem to have been guilty of a deliberate seduction, the one of his daughter, the other of his destined bride. Yet, not to return to Gethin in such a case would be worse than cowardice, since his absence would be sure to be associated with Harry's midnight expedition. He had hitherto only despised this Trevet-hick and his friend, but now, since he feared them, he began to hate them. Bodily discomfort combined with his mental disquietude. For the first time, he felt the keenness of the moonlit air, and shivered in it, notwithstanding the hasty strides which he was now taking homeward. Upon the hill-top he paused, and glanced about him. All was as it had been when he set out; there was no sign of change nor movement. The inn, with its drawn-down blinds, seemed itself asleep. The front-door had been left ajar, doubtless by Harry; he pushed his way in, and silently shut it to, and shot the bolt; then he took off his boots, and walked softly up-stairs in his stockinged feet. He knew that there was at least one person in that house who was listening with beating heart for every noise.

The ways of clandestine love have been justly described as 'full of cares and troubles, of fears and jealousies, of impatient waitings, tediousness of delay, and sunderance of affronts, and amazements of discovery;' and though Richard Yorke had never read those words of our great English divine, he had already begun to exemplify them, and was doomed to prove them to the uttermost.

ACROSS THE WALNUTS AND THE WINE.

In after-dinner talk
Across the walnuts and the wine.—TENNYSON.

THE war, as a topic of talk, has absorbed all other topics on the tongues of men. There have been of late disclosures of prodigies of vice, murders that have been almost unexampled in their wholesale horror, and grim Death busy among our best and noblest; but all this, so morbid, sad, and sombre, and therefore (deny it as we will) so attractive to men's minds, is forgotten in the greater attraction of the bloody drama whose first act is being played by the whole strength of two great nations, with the rest of Europe for spectators. The war, like Aaron's serpent, swallows up all.

At Housewife's table, as elsewhere, nothing else is talked of; and in the opinions of the little company that assembles round it is found an epitome of the public 'view.' We are neither French nor Prussian, but exclaim with all the English world: 'A

plague on both your houses.' In this respect, notwithstanding the mournful exhibition which is presented to us of two great peoples, supposed to be civilised, fleeing at one another's throats like dogs, over the mangy bone of 'Dynasty,' we may congratulate ourselves on some advance in social intelligence and morality. With the exception of a very few thoughtless or cruel persons—chiefly the former, who do not care to ask themselves what war means—the conflict is regarded here as an act of wanton wickedness, and as a disgrace to Europe and our age. There is no hounding on of either the one party or the other; if we could flog them both, and bid them back to kennel, we would do so.

It was Housewife himself who is supposed to have written that famous letter in the *Times*, before hostilities commenced, recommending England's navy to blow to pieces every stick afloat belonging to the Power that should first break the peace of Europe. It is quite a treat to hear his honest wholesome indignation at the shifty ways of French and Prussian diplomacy and the lies of emperors and kings.

'Why, we used to think,' cried he, 'we of the bluff true blue, who respected authority, and those whom Heaven had made our rulers, that Truth would always be found, if nowhere else, at least in the mouths of kings.'

'Did you?' responded Mr Aloes blandly. 'You must have been very sanguine.'

'And very disinclined to be taught by experience,' added Professor Puzzleton. 'Why, Kingcraft and Diplomacy have been synonyms for lying from first to last. You may take it as a rule that everything that is made a secret of has something shameful about it, and that everything you pay a fancy price for is more or less intrinsically worthless. If all the Hohenzollern and Napoleon broods were swept from the earth to-morrow, what would it matter? The Joneses or the Johnsons would fill their places equally well. "Let them that make the quarrel be the only men to fight," should be—and will be one day—the motto of mankind. The working-man—who is really the one to suffer in these atrocious conflicts—will at no very distant time refuse to give himself to be slaughtered, and his family to be starved, or worse, for the sake of his so-called rulers.'

'Oh, excuse me,' interrupted Mr Scale Hill; 'I have only just returned from Paris, and the enthusiasm in favour of the war is universal. With one of the two peoples, at all events, it is not an affair of dynasties—it is an outbreak of national passion.'

'But by whom fomented?' broke in the Professor. 'By a cunning fellow, who takes advantage of the vanity and folly of his fellow-countrymen. And even now he has not the backbone of the nation with him. He has that curse of the times, his huge standing army, to keep whom quiet he must needs wage war; he has the thoughtless students, and the mob of the great towns; and he has the priests. But the manufacturer, whose business is paralysed by the first trumpet-call; and the farmer, whose fields lie fallow for lack of hands; and the labourer himself, who draws his "bad number," and has to shoulder rifle, and leave his widowed mother, or his unprotected wife and children—do you mean to tell me that *they* desire war? Good God! what wicked talk is this! Do you know what war means, sir, to the country that

is invaded? It means butchery of the defenceless, starvation of the innocent, and inexpiable and unmentionable wrongs to the good and pure! To hear the men who have invoked such miseries upon the earth take the name of the All-Merciful into their mouths, and appeal to Him for aid, is, to my mind, a blasphemy the most shocking conceivable.

"These things are merely Continental," quoted Mr Bitter Aloes; "you will never work the public mind in England up to your point of view, Puzzle-ton—simply because we have no experience of such a dreadful state of things as you depict. It is only a few of us (who happen to have read *Le Conscrié*) who can enter into it at all. If this war had broken out in the winter, you would not have found our upper classes finding any fault with it; but they are naturally irritated at being debarred from their French and German tours at this particular season of the year."

"I think better of them than *that*," answered the Professor.

"And I too," exclaimed Housewife eagerly.

"This is very nice," continued Mr Aloes softly, "and does you both great credit. It is quite refreshing to hear such sentiments, especially since they are decidedly uncommon. But seriously, do you mean to tell me that there was not a marked increase among us of disapproval of this war, when the special correspondents of our newspapers were prohibited from purveying to us their highly spiced and deeply interesting records of it? I don't speak of the bitter tone of the newspapers themselves, which, of course, is natural enough; but did not our own morality become more severe when we found that our appetite for sensation was not to be tickled? Nay, was not our reprobation of the French especially noticeable, because it was by the emperor's orders that this dainty dish was denied to our breakfast-tables?"

"That may have been the case with a few selfish persons," observed Housewife gravely; "but, so far as I observed, the prohibition had no such general effect; while, as for our antagonism to France, that was surely explicable enough on the ground of the projected Treaty. To think that a man that has been an ally for so many years should plot against us in the dark, and seek impunity for theft!"

"I beg your pardon," interrupted Colonel Thunderbomb, "but which of those two gentlemen—emperor or king—are you speaking about?"

"Why, the emperor, of course: the Treaty was in his own ambassador's handwriting; the infamous suggestion must have therefore come from his side."

"Pardon me," said Thunderbomb. "Let me recall to your recollection what occurred last autumn at our *Megatherium* Club. Do you remember Captain Dyer's fate with the committee with respect to that communication from Captain Duceace which he laid before them? The latter had made a cool proposition to the former that they should cheat us at cards in concert, and divide the gains between them; and he had had the great imprudence to put his views in writing. "Gentlemen, did you ever see anything so infamous as this document?" inquired Dyer with an honest indignation. "Never," replied the committee. "But it also appears to us, by the terms of the proposition in question, that you must have met this gentleman's scheme half-way; or, at least, that he must have discovered you were a scoundrel,

before venturing to treat upon such a delicate matter at all." The end was that they both had to go: and I wish we could turn Bismark and Napoleon out of the European Club with equal facility."

"A very just illustration of the whole matter," remarked the Professor approvingly. "But while expressing our detestation of the baseness of both parties, we should be careful to acquit the innocent. We have no quarrel with the French or German peoples. It is their rulers alone who are to blame for this act of treachery; and if diplomacy was not the thing it is, a deed of the dark, such a crime would have been impossible even to them. At present, I am thankful to say that not the slightest sympathy has been evinced by England for one rogue or the other."

"Except by the military," remarked Mr Bitter Aloes.

"I beg your pardon, sir," exclaimed the Colonel angrily. "Her Majesty's army have exercised a dutiful reticence, not knowing upon which side it may be necessary for them to act."

"I was referring," explained Mr Aloes, "to the two full privates in full uniform who crossed from Dover to Calais, and offered themselves as a British contingent to the emperor's army."

"They ought to have been sent back and shot, sir," exclaimed the Colonel very irascibly. "It was evident that the dread war-fever had seized upon at least one victim, even in Housewife's peaceful household, and we at once removed with the patient into the drawing-room, where everything is well ventilated, but discussion upon exciting topics is forbidden."

Here we found our hostess and her young Hopeful making a strategical campaign upon the draught-board.

"I have got something for you, my boy," cried the Professor cheerfully. "It is neither a war-pony nor a pop-gun, nor anything that costs money, but something made out of my own head."

"It must be some wooden toy," whispered Mr Bitter Aloes.

"Listen," said the Professor, "and read me this riddle aright:

Not upon Alpine snows or ice,
But homely English ground;
Excelsior was their high device,
But low the fate they found.
They did not go for love of Fame,
But at stern Duty's call:
They were united in their aim,
Divided in their fall."

None of us guessed it, of course, until we got a hint; nobody ever does guess riddles, unassisted—unless they have heard them before.

"It is a simple English ballad paraphrased or travestied," said the Professor.

"Then I've got it!" cried Mrs Housewife. "It's:

Jack and Jill went up the hill
To fetch a pail of water;
Jack fell down, and broke his crown,
And Jill came tumbling after."

"You are sharper than all the rest of them put together," exclaimed the Professor admiringly.

"Nay, rather, was our hostess' modest rejoinder; 'I'm the latest from the nursery and nursery ballads, by reason of my little boy here.'

We had a charming domestic evening, and as I came away under the star-lit skies, I could not help contrasting it sadly with those that must needs be passing elsewhere, where wife and child are parted from the bread-winner, and await at home with heavy hearts the tidings from the battle-field.

THE MONTH:

SCIENCE AND ARTS.

WAR, with its cruel devastation and startling rumours, once more prevails on the continent; and to gratify the ambition of one man, the progress of civilisation must be stopped, and peace and prosperity banished. It is lamentable to reflect that in this age of the world those who love peace should not have the power to compel the quarrellers to keep the peace. And now while one part of Europe is holding international working-men's exhibitions, and is planning for others, and the British Association is about to meet at Liverpool, human ingenuity is to be exercised elsewhere in perfecting schemes and instruments of slaughter, among which the *mitrailleuse*, or grape-shooter, is to produce startling effects.

Meanwhile other questions are getting settled: it appears to be a conclusion that the open ground of the Thames Embankment shall not be built on; the new St Thomas's Hospital, one of the finest ranges of buildings in London, and the handsomest hospital in the world, is approaching completion; the Geographical Society have bought a large house at the corner of Saville Row, and are there establishing their headquarters, map-room, library, and offices. It is a good site, and has the advantage of being close to the London University, in which they are to hold their meetings. It is hoped that good news of Dr Livingstone will have arrived by the time they open their next session in November.

The International Working-man's Exhibition, now open, is well worth a visit. One of its leading merits is, that the names of employers, of manufacturing firms, are not used to mask those of the actual constructors and producers of the articles exhibited. If the name of the employer is worthy of recognition, so is also that of the workman.

The construction of a reflecting telescope, by a man who for some years has followed the trade of baker and grocer at Nottingham, is a fact worth notice. Except some of the heavy iron-work which forms the stand, he has himself made the whole of the instrument, and by observations on certain test stars has proved its excellence. To those who know what the construction of such an instrument involves, the nice calculation, and combined delicacy and strength of workmanship, this telescope will appear as the most noteworthy object in the Exhibition. Mr T. W. Bush, the maker, has set an example to the working-men of England, which should make thousands of them ashamed of the low objects on which they waste their time and opportunities.

Chemists are wont to say that the more a substance is examined the more does it appear to contain of properties and principles. The same apparently may be said of iron, for the more the manufacture of that metal is improved the more does it appear susceptible of improvement, as may be seen in the Exhibition above referred to. There are specimens of iron manufactured from pig-iron, which had been used as ballast, by a process invented by Sir Antonio Brady of the Admiralty. The process is so good that it converts iron which at 45s. a ton would hardly find a customer into iron worth L14 a ton, and as this can be done at a cost of about 35s. a ton, the profit may be regarded as satisfactory. All the sulphur and all the phosphorus, which render iron so brittle and worthless, are completely got rid of, and a metal is produced which, whether thick or thin, comes out successfully from any test to which it may be subjected. It may be bent and beaten, hammered flat to any extent, may be punched and treated in any way whatsoever without abating one jot of its toughness or shewing any sign of a flaw. After so much of favourable description, the question arises: could not this iron be used for the axles of railway-carriages, and also for the wheel-tires? and so enable the public to travel with less risk of accident than at present. Sir Joseph Whitworth has an enormously strong iron for making guns: is Sir Antonio Brady's iron likely to compete with it?

Considering the grievous consequences to life and property occasioned at times by the breaking of a railway carriage axle, Sir Joseph Whitworth has made known for the information of railway directors and all concerned, that the best way for discovering a flaw is to drill a one-inch hole through the whole length of the axle. By using a small lamp, or reflector, it would be easy to inspect the interior, and a flaw could hardly fail to be detected. The axle would not be weakened by the hole, because the portion drilled out would be that which mechanical philosophers describe as the 'neutral axis,' which adds nothing to the strength. And there would be the further advantage, that with a hole in its centre, the axle would not be liable to get overheated.

All persons who know what crossing the sea from England to the continent implies in stormy weather, will feel interested in an experiment which Mr Bessemer intends to try in the course of next autumn, if not prevented by the war. He has made his name famous by his process for the manufacture of steel; but among tourists generally, it will become still more famous should the new project succeed. He believes it is possible so to suspend a circular saloon or cabin that it shall retain a steady position in any sea, and he is having a steamer built to try the question. However much the vessel may be tossed by angry waves, no disturbance is to be felt by the occupants of the saloon, who, in consequence, are not to suffer from sea-sickness. It is not the first time such a question has been mooted; but it has never yet been put to the test on such a scale as is now proposed. It will be understood that the saloon is to be properly fitted up for the convenience of passengers; but we need not go into details until the

trial shall have shewn whether the theory of suspension will be confirmed by practice or not.

Meyer of Heilbronn is well known among scientific men for his profound researches in natural philosophy. In treating of the 'Dynamics of the Heavens,' he says: 'As cosmical masses stream from all sides in immense numbers towards the sun, it follows that they must become more and more crowded as they approach thereunto. The conjecture at once suggests itself that the zodiacal light, the nebulous light of vast dimensions which surrounds the sun, owes its origin to such closely packed asteroids. However it may be, this much is certain, that the phenomenon is caused by matter which moves according to the same laws as the planets round the sun, and if consequently follows that the whole mass which originates the zodiacal light does not surround the sun uniformly on all sides; that is to say, it has not the form of a sphere, but of a thin convex lens, the greater diameter of which is in the plane of the solar equator, and consequently it has to an observer on our globe a pyramidal form.' This passage may be commended to the attention of the gentlemen who are to take part in observation of the eclipse in December next: more than on any former occasion of the kind will they have to endeavour to solve great cosmical questions.

A recent discovery in chemistry has established the fact that the pure colouring substance of madder—*alizarine*—can be extracted from coal-tar. The process by which this discovery was achieved was worked out in a most philosophical way by two German chemists; modifications have been introduced, and now there are four methods by which artificial alizarine, a brilliant scarlet substance, can be produced. Madder costs forty-five pounds a ton, and the quantity imported into England is worth £1,000,000 a year; consequently, the discovery of a method by which its colouring principle can be derived from a material which we possess in abundance is of prime importance commercially. With alizarine at command, a dyer, by varying his mordant, will produce a great variety of colours and tints: with iron, he gets the series from the lightest mauve down to black; with alumina, all the varieties of pink and crimson, including the brilliant Turkey red, and by a mixture of these two, different shades of chocolate are produced.

In the distillation of coal, a substance is obtained to which chemists give the name *anthracene*, and it is out of this, by a beautiful synthetical process, that they extract alizarine. Then it becomes important to determine whether this alizarine is really the same as the colouring principle of madder; and here the spectroscope comes into play, and it is found that the absorption spectra of the two substances are identical, and thus refinements in chemical science are confirmed by refinements in optical. And now the question is as to the production of anthracene in sufficient quantity. One authority states that two thousand tons of coal must be distilled to obtain one ton of anthracene; but Mr W. Crookes, F.R.S., has shewn that some kinds of coal-tar contain a very large amount of anthracene. Hence, we may suppose that for some years to come manufacturing chemists will exercise all their ingenuity in endeavours to extract the largest possible quantity of anthracene from coal. Meanwhile the price of anthracene is regularly

advertised in the chemical journals, thereby shewing that its production has become a steady branch of industry.

It is known to many readers that an act of parliament exists known as the 'Alkali Act,' for the prevention of pollution of the air by chemical works. Under this act, trials at law have been held in Lancashire for damage done to crops by the noxious gases from the works, particularly in the neighbourhood of St Helens, where muriatic, sulphuric, sulphurous, and nitrous acid, chlorine, vapour of common salt, and sulphide of hydrogen were discharged from the chimneys in large quantities, to say nothing of ordinary smoke. The quantity of gas poured out by each factory can be easily estimated; and it was found possible, by analyses of snow and of water, taken up at different distances, to estimate the share that each factory had in doing mischief. Consequently, if a farmer recovered £100 for damage to his crops, the proportion for which each manufacturer in the neighbourhood was liable, according to distance, could also be estimated. This is a practical application of science to the cause of fair-play which is worth recording; and it teaches us that legislation on the subject could be carried farther than at present, so that eventually the noxious gases, instead of poisoning the atmosphere for miles around, should either be consumed or utilised on the spot where they are produced. The inspector would publish from time to time a list of the factories, shewing the amount of acid poured forth by each, and this list would become a basis for assessment in an action for damages. As regards the factories, the publication of this list would be like giving a certificate of character; and as a factory with a bad character would have most to pay in the shape of fine, it would become the interest of the proprietors to prevent the escape of the injurious matters, and thereby secure for themselves a good name and position on the inspector's periodical list.

A T W A R.

NIGHT yields to day, the day yields to the night;
The coursing of the orbs is timed so true,
Light follows darkness, darkness follows light,
And morning evening, all the seasons through.
The Spring returns to deck the earth anew,
Endowed with powers that grim old Winter lacked;
The dusk's preceded by the falling dew;
The moon is by the lesser planets tracked.
All natural things in natural order move:
But as for me, a counter-current flows
Through all my soul; order of peace and love
Yields to a chaos, wild with griefs and woes;
While the harmonious sameness of the days
Jars my sad heart to tread their trodden ways.

With reference to the paper *Is the World Round?* published in a late number of this Journal, we are requested by both parties to state that *Parallax* and *John Hampden* are not identical personages. The sentence in the same article, 'a hill one hundred fathoms high would be hid at the distance of ten miles,' should run, 'a hill 91 fathoms high would be hid,' &c.

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